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FOREST RESEARCH NOTES

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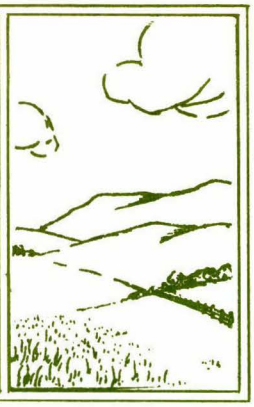

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LUMBER REQUIREMENTS[1/] OF THE CALIFORNIA FRUIT AND VEGETABLE INDUSTRIES

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INTRODUCTION

Agricultural shook for field and shipping containers is the largest use of lumber produced in California. Wood has proved to be the most suitable material for such containers because of its ability to withstand comparatively hard usage and its relative resistance to moisture and temperature changes. Boxes constructed of wood combine the qualities of rigid support and flexibility, which have not yet been satisfactorily duplicated in other materials.

This foremost lumber use derives from the importance of fruit and vegetable production in California. In 1944 California led all other States in cash receipts from farm marketing of fruit and vegetables. Its cash farm income of about 662 million dollars for fruits and of 284 million dollars for vegetables represented 47 percent and 19 percent respectively of the national cash farm income for these products. No other State total equaled more than about 22 percent of the California income from fruit production nor more than 36 percent of its income from vegetables[2/].

1/ Excludes plant maintenance and new construction.
2/ Revised cash receipts from marketings of crops. The Farm Income Situation. U. S. Bur. Agr. Econ. February 1945. (Processed).

* MAINTAINED AT BERKELEY, CALIFORNIA, IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA.

Several of the more important fruits and vegetables are harvested and transported to packing or processing plants in the customary picking box or field lug. For commercial marketing fruits and vegetables are shipped largely in specially designed wooden shipping containers, which prior to the war varied widely in size and form but during the war tended more to standardization for each commodity. Rail shipments are held in place by bracing lumber and stripping material. Wooden trays are used in sun-drying and dehydration of certain fruits and raisin grapes, and sweatboxes serve mainly as farm storage receptacles for dried fruits and raisins during the period of moisture equalization termed "sweating".

A preliminary study of agricultural box shook requirements in California was made in January 1943 by the California Forest and Range Experiment Station, at the request of the Office of Agricultural War Relations of the U. S. Department of Agriculture. The results of this study indicated that construction of agricultural containers constituted the most important use of lumber produced in California. As a national reappraisal of timber supplies was made in 1945, it seemed advisable to investigate further this part of the lumber consumption picture, which is so important to California agriculture. This report, therefore, combines the findings of the 1943 study with the more detailed data obtained in recent months.

ACKNOWLEDGMENTS

Special mention should be made of assistance received from: (1) Dr. S. W. Shear, Giannini Foundation of Agricultural Economics, University of California, Berkeley, Calif.; (2) Wendell T. Calhoun, Agricultural Economist, Bureau of Agricultural Economics, Berkeley, Calif.; (3) Jack H. Dobbin, Secretary Manager, Pacific Division, National Wooden Box Association, San Francisco, Calif.; and (4) H. C. Dunlap, of the Dried Fruit Association, San Francisco, Calif.

The authors were cordially received wherever they sought information and it is regretted that individual mention cannot be made of all persons who furnished information of value to the study. Needless to say the study would have had little value without the basic information supplied by producers and distributors of box shook; growers, shippers, and canners of fruits and vegetables; and growers associations.

SCOPE OF STUDY

The report comprises (1) estimated lumber requirements for agricultural shook for the California fruit and vegetable industries as a whole, and for fresh and processed products separately; (2) estimated production of agricultural shook in California; and (3) the outlook, including a discussion of probable requirements, possible developments, and requirements compared with production. Lumber for plant construction and maintenance is not included in these estimates.

LUMBER REQUIREMENTS FOR AGRICULTURAL SHOOK

Table 1 summarizes the lumber requirements for the fruit and vegetable industries in California for 1944 in terms of shook and for 1940-44 in terms of both shook and gross lumber footage.

Table 1.- Lumber requirements for agricultural shook, fruit and vegetable industries, California; 1944 and average 1940-44 1/

Container or other use	Shook requirements (average "fall-down" in manufacture: boxes, 15% trays, 25%.)		Gross lumber requirements, average 1940-44
	1944	Average 1940-44	
	M bd. ft.	M bd. ft.	M bd. ft.
Vegetable	264,540	247,010	290,600
Citrus fruit	199,220	214,690	252,580
Deciduous fruit and grapes	128,240	138,430	162,860
Total for fresh fruits and vegetables	592,000	600,130	706,040
Stripping lumber	29,610	28,680	28,680
Bracing lumber	27,140	26,290	26,290
Dried fruit	24,980	24,980	29,390
Picking boxes	25,000	25,000	29,410
Drying trays	10,040	10,040	13,390
Dehydrator trays	2,360	2,360	3,150
Sweatboxes	4,000	4,000	4,710
Total for miscellaneous uses	123,130	121,350	135,020
TOTAL	715,130	721,480	841,060

1/ Bases for estimates are described in the text under the separate headings (pp. 5 - 7).

For Fresh Fruit and Vegetable Shipments

Box Shook

Container requirements for shipment of fresh fruits and vegetables in terms of gross lumber volume represent about 84 percent of the total requirements for the California fruit and vegetable industries. For

1940-44 roughly 600 million board feet of lumber was used for fresh fruit and vegetable containers. By commodity groups the requirements were 247 million board feet for vegetables, 215 million for citrus fruits, and 138 million for deciduous fruits and grapes.

Shook requirements are as given in table 2 by commodities. The estimates are based on the amount of shook required for containers per car and the number of carlot shipments[3] of major commodities.

The amount of shook required for containers per car was calculated from the following information: (1) size of container most commonly used for each commodity[4]; (2) number of board feet per container[5]; (3) number of packages per carload[6]. An average of 1,525 board feet of shook is required per carload of vegetables, 1,914 board feet per carload of citrus fruits, and 2,500 board feet per carload of deciduous fruits.

The carlot shipments include the carlot equivalents of total truck shipments within the State. Total intrastate truck shipments are usually assumed to be double the unloads at San Francisco and Los Angeles because only about half the State's population is in these two metropolitan areas. However, many of the products consumed in the interior valleys or received in metropolitan areas, particularly Los Angeles, are not packed in the usual shipping containers but are handled in bulk or in second-hand containers. To reflect truck shipments requiring new shook, therefore, a more reliable figure was obtained by adding to the San Francisco-Los Angeles truck unloads only 50 percent of the volume of such receipts instead of doubling it. Carlot shipments of peaches, pears, apricots, and grapes have been adjusted to exclude rail shipments of these products to processing plants, since the container used is the usual field lug box, which remains in service for years.

3/ California carlot shipments of fruits and vegetables (for the years 1940-44). U. S. Bur. Agr. Econ. 5 nos. Washington, 1941-45. (Processed.)

4/ According to information supplied by box producers, growers, and shippers, and from Containers for Fruits and Vegetables, by L. C. Carey. U. S. Dept. Agr. Farmers Bul. 1821. 63 pp. Washington, 1939.

5/ Official Nation-wide specifications of nailed boxes and crates for fruits, vegetables, and melons, fresh, dried, and canned. Natl. Wooden Box Assoc. Natl. Wooden Box Tariff No. 1. 80 pp. San Francisco, 1943. (Processed.)

6/ Table of number of packages per carload. U. S. Bur. Agr. Econ. 32 pp. Washington, 1937. (Processed.)

Table 2.- Carlot shipments and shook requirements, California fresh fruit and vegetables, 1944 and average per year 1940-44. 1/

Commodity	Commonly used container: Tariff Number	Page	Shook Bd.ft.	Packages per car	Shook per car Bd. ft.	Carlot shipments: 1944	Carlot shipments: Average, 1940-44	Shook requirements: 1944 M bd. ft.	Shook requirements: Average, 1940-44 M. bd. ft.
Vegetables									
Asparagus	5	1	3.33	640	2,131	3,212	3,855	6,844	8,215
Beans (snap & lima)	47A	29	4.60	320	1,472	2,352	3,100	3,462	4,563
Beets	47A	29	4.60	320	1,472	1,003	1,223	1,476	1,800
Broccoli	46	8	3.31	440	1,456	2,362	1,881	3,439	2,739
Cabbage	47A	109	3.07	400	1,228	6,749	6,510	8,288	7,994
Cantaloupes	32a	15	4.10	288	1,181	14,291	10,925	16,878	12,902
Carrots	47A	29	4.60	320	1,472	17,913	16,275	26,368	23,957
Casabas	32a	15	4.10	288	1,181	596	472	704	557
Cauliflower	46	8	3.31	440	1,456	10,844	9,123	15,789	13,283
Celery	48A	171	3.19	350	1,116	15,903	16,963	17,748	18,931
Corn	47A	109	3.07	600	1,842	2,258	2,310	4,159	4,255
Cucumbers	41	27	2.57	1,000	2,570	717	887	1,843	2,280
Greens (except spinach)	47A	29	4.60	300	1,380	1,185	1,155	1,635	1,594
Honey Ball melons	32a	15	4.10	288	1,181	326	564	385	666
Honey Dew melons	33	49	3.40	500	1,700	4,142	3,317	7,041	5,639
Lettuce and romaine	47A	29	4.60	320	1,472	57,364	49,416	84,440	72,740
Mixed melons	33	49	3.40	500	1,700	970	1,172	1,649	1,992
Mixed vegetables	47A	29	4.60	320	1,472	11,198	9,739	16,483	14,336
Peas (green)	49	184	2.68	650	1,742	4,307	4,644	7,503	8,090
Peppers	49	400	3.90	400	1,560	1,208	1,097	1,884	1,711
Persian melons	32a	12	3.66	288	1,054	802	670	845	706
Spinach	47A	29	4.60	320	1,472	2,272	2,479	3,344	3,649
Strawberries	8	18	1.26	1,200	1,512	345	1,420	522	2,147
Sweet potatoes	42a	47	3.25	500	1,625	2,116	1,939	3,438	3,151
Tomatoes	29	756	2.68	650	1,742	14,962	15,321	26,064	26,689
Turnips and rutabagas	47A	29	4.60	320	1,472	1,567	1,644	2,307	2,420
TOTAL VEGETABLES						180,964	168,101	264,538	247,006
Citrus fruits									
Grapefruit	34	3	4.26	460	1,960	4,231	5,081	8,293	9,959
Lemons	26	56	4.44	400	1,776	20,384	22,451	36,202	39,873
Mixed citrus	34	3	4.26	460	1,960	2,913	2,793	5,709	5,474
Oranges and Satsumas	34	3	4.26	460	1,960	76,030	81,319	149,019	159,385
TOTAL CITRUS						103,558	111,644	199,223	214,691
Deciduous fruits and grapes									
Apples	1	36	4.79	760	3,640	3,291	4,294	11,979	15,630
Apricots	3	4	2.45	1,100	2,695	2,389	1,309	6,438	3,528
Cherries	15	27	2.68	1,100	2,948	1,390	1,111	4,098	3,275
Grapes	28	700	2.57	1,000	2,570	24,533	30,296	63,050	77,861
Mixed fruits	35	39	1.41	1,300	1,833	620	464	1,136	851
Peaches	35	39	1.41	1,300	1,833	10,482	8,397	19,213	15,392
Pears	36A	20	2.62	675	1,768	4,365	5,501	7,717	9,726
Plums and fresh prunes	41	27	2.57	900	2,313	5,980	4,891	13,832	11,313
Tangerines	17	49	3.63	800	2,904	267	294	775	854
TOTAL DECIDUOUS FRUITS & GRAPES						53,317	56,557	128,238	138,430
TOTAL						337,839	336,302	591,999	600,127

1/ Sources of information and bases of estimates are described in full on page 4.

Car bracing and stripping

In addition to the boxes, each carload of fruit or vegetables requires, on an average, 110 board feet of bracing lumber and 120 board feet of lath stripping to secure the load. As about 239,027 carloads were shipped annually by rail during 1940-44, the estimated volume of lumber used was about 26 million board feet for bracing and about 29 million board feet for stripping.

For Processed Fruits and Vegetables[7/]

Dried fruit

About 560,000 tons of dried fruit was produced in California in 1944 of which 25 percent, or 140,000 tons, was packed in wooden boxes[8/]. The standard 25-pound dried-fruit box contains 2.23 board feet. The shook requirement for dried fruit boxes, therefore, is 25 million board feet.

Picking boxes

It is extremely difficult to estimate the annual requirement for picking boxes because of the almost complete lack of reliable data. These boxes are used extensively in harvesting eight fruits and two vegetables. They are often reused several times during a season, and the number of years they remain in service depends upon the care used in handling. Information on this subject was solicited from canners, shippers, and growers. The concensus seemed to be that about five picking boxes were required per ton of produce. Therefore, on the basis of tonnage produced and an average life of 10 years for the container, approximately 2,582,000 boxes are required annually for replacement. As these boxes contain 4.7 board feet, the annual shook requirement for new picking boxes is about 12 million board feet. The information received also indicated that an approximately equal footage was needed for the repair of old picking boxes. The total requirement, therefore, for box shook used in new picking boxes and for repair is roughly 25 million board feet.

Sun-drying and dehydrator trays

It is estimated that about 10 million board feet of shook is required annually for trays used in sun-drying deciduous fruits and raisin grapes and slightly more than 2 million board feet for dehydrator trays[9/]. For each fruit separately and for each method of drying, these estimates take into account (1) the average annual volume dried; (2) the length of the drying season; (3) the time required to dry each spread or charge; (4) the number of times each tray is used per season;

7/ Excludes cannery shook. Fiberboard has largely replaced wood in the manufacture of shipping containers for this purpose and lumber now used is relatively unimportant.

8/ Estimates supplied by H. C. Dunlap, Dried Fruit Association. San Francisco, Calif.

9/ Based on estimates furnished by Dr. S. W. Shear, Giannini Foundation of Agricultural Economics, University of California, Berkeley.

(5) the number of pounds of fresh fruit per tray; (6) the ratio of fresh weight to dry weight or drying rates; and (7) the average tray life, which was assumed to be 10 years for sun-drying and 6 years for dehydration. From these data it was possible to estimate the total number of trays required and the number of each kind required annually for replacement. The conversion to board feet of shook was accomplished by multiplying the number of trays needed for replacement by the footage contained in the average-sized tray (10.31 feet b.m.).

Sweatboxes

Approximately 4 million board feet of shook is required annually for sweatboxes used in storing dried peaches, apricots, figs, and raisins during the period of moisture equalization and preceding final packaging for market[10/]. The sweatbox preferred in practice is constructed of pine lumber and has a capacity of about 200 pounds. This size box contains about 16.11 board feet of shook. It is generally used once during the season and has an average life of about 12 years. The annual shook requirements were estimated from these data and the average volume of the designated fruits dried per season.

ESTIMATED PRODUCTION OF AGRICULTURAL SHOOK

Approximately 45 box factories in California produce agricultural shook. Most of them are operated in conjunction with sawmills. Although a few factories maintain selling organizations, the majority sell through distributors handling only this phase of the business. The four distributors that handle the bulk of the sales maintain storage warehouses and assembly plants strategically located throughout the State. Because of lack of labor many of the assembly plants were closed during the war. With the advent of normal times it is presumed that these services will again be offered to purchasers of box shook.

During the war inventories of box shook in the hands of producers, distributors, and consumers were extremely low. Therefore the records of shipments from mills were a fairly accurate representation of production for the period. Box lumber in normal times grades about 75 percent No. 3 Common and 25 percent No. 4 Common. Obviously, with this grade of lumber, there is considerable "fall-down" in the manufacture of shook. The accepted figure is 15 percent.

10/ Estimated from data supplied by Dr. S. W. Shear, the Dried Fruit Association, and information available in Methods and Equipment for the Sun-Drying of Fruits, by E. M. Mrak and J. D. Long. Agr. Expt. Sta. Circ. 350, Berkeley. 1941.

In 1944 California factories produced approximately 500 million board feet of agricultural shook[11/] from 588 million feet of lumber. Not all of California's shook production, however, was available for local use. About 5 percent, or 25 million board feet, was shipped to consumers in such States as Utah, Nevada, New Mexico, Colorado, Arizona, and Texas. These States produce agricultural shook but the amount falls short of requirements.

If the California supply warrants, it is predicted that the out-of-State shook shipments will be approximately the same as in 1944, perhaps slightly greater. Reasons offered include: (1) Growers in Texas and Arizona prefer California shook because of its better quality. (2) Old customers in out-of-State markets will be retained. (3) Shipments to other sections of the country (mainly apple shook to eastern growers), which were discontinued during the war, may be resumed.

The difference between the volume of shook required in the State (721 million board feet) and the volume produced and used locally (475 million board feet) is 246 million board feet, or 34 percent. All but a small amount of this deficit was produced by factories located principally in the area from Bend to Klamath Falls in Oregon. The production of factories in the Pacific Division area (western, central, and southern Oregon, California, Arizona, New Mexico, and Colorado) exceeded California's total requirements by only about 100 million feet.

THE OUTLOOK

Probable Requirements, 1945-64

In terms of carloadings per year commercial marketings of California fruits and vegetables that are customarily marketed fresh in new wooden containers have averaged about 10 percent more during the 4 years of the war (1940-44) than during the 10-year period immediately preceding and about 7 percent more than during the 15-year period since 1930[12/].

11/ Statistics supplied by Mr. Jack Dobbin, Secretary-Manager, Pacific Division of the national Wooden Box Association, were largely the basis for this estimate. In addition California factories produced about 86 million board feet of war and industrial shook. Thus agricultural shook represented about 85 percent of total 1944 shook production.

A much smaller annual volume of non-agricultural shook is forecast in peacetime. Agricultural shook will therefore make up a larger proportion of total production (possibly as much as 95 percent) in the years ahead.

12/ Based on data supplied by Wendell T. Calhoun, Agricultural Economist, U. S. Bureau of Agricultural Economics.

Requirements for agricultural containers are difficult to forecast. Material changes may occur during the next two decades in the proportions of fruits and vegetables marketed in fresh and in processed form. Competing areas of production may cut into the volume of fresh products shipped from California, and changing methods of transportation and distribution are likely to affect the volume packaged in the customary types of containers — whether those containers be made of wood or other materials. Such changes cannot be predicted.

Nevertheless, most competent observers believe that California fruits and vegetables will retain approximately their present proportion of the national market and that commercial marketings of the major commodities will continue at about the present level. This assumption is based on past history and indicated trends of production and utilization.

Possible Developments

Since commercial marketings of California fruits and vegetables are expected to continue at about the present level, it follows that annual lumber requirements will also remain about as great — 841 million board feet. The greatest single factor that can logically be expected to reduce present-day shook consumption and force a shift to substitute materials for containers is the predicted decline in mill output in the relatively near future because of dwindling supplies of raw material.

Production of agricultural shook during the war years has been a constant source of worry for both the consumer and the producer. The shortness of the supply was accentuated by the heavy demand for industrial shook for overseas shipment of military equipment — an obligation that had to be shouldered for the most part by existing agricultural shook factories. Supply ever since Pearl Harbor has been barely adequate, and the situation will very likely remain unfavorable in view of a continuing heavy demand as contrasted to the ever-decreasing supply of suitable and readily available timber. It is estimated that many of the California pine region mills will be out of stumpage within a relatively few years. An indication of the anxiety about this is the recent purchase by the Fruit Growers Supply Company (Sunkist) of 80,000 acres of timber. The express purpose of this transaction was to secure an additional supply of timber badly needed to sustain its output of box lumber. Lumber used annually in the manufacture of citrus crates alone (about 50 million) for the period 1940-44 grossed 252,580 thousand board feet. Only the requirements for vegetable shook exceeded this figure.

Continuing heavy demands for agricultural shook during the years ahead will very likely result in greater use of species now considered inferior to the commonly used ponderosa pine. A trend in this direction is already evident in the use of white fir for containers, which has increased considerably in recent years. White fir lumber production in California has nearly tripled since 1941. A continuing trend in this direction, together with a greater utilization of second-growth ponderosa pine, which theoretically should show a gradual increase as

the old-growth timber is removed, will tend to relieve some of the pressure on old-growth ponderosa pine. However, it is doubtful whether these sources of supply will take up the full slack. A companion development, assuming a lumber deficit in the near future, will logically be substitutes for wood in the construction of containers for fresh shipment or greater reliance on lumber sources outside the State.

Requirements Compared with Production

Although the fruit and vegetable industries in California require approximately 841 million board feet of lumber annually for agricultural shook, only about 588 million feet of lumber from California, or approximately 24 percent of the volume produced (2,469 million feet), was converted into shook for agricultural use in 1944. Ponderosa pine is the species considered the most suitable for containers and has been the species most widely used for this purpose over the years. According to census compilations, about 1,059 million board feet of ponderosa pine lumber was produced by the California pine-region mills in 1944. If ponderosa pine had been used exclusively, approximately 55 percent of this output would have been converted into agricultural shook. Other species, however, (mostly sugar pine and white fir), were used to some extent and since practically all the agricultural shook manufactured in California is from lumber produced in the pine region the proportion of the regional output (1,821 million feet) that was converted into agricultural shook was 32 percent. About 46 percent of pine region production would be needed if the full requirements of the industries of 841 million board feet were supplied within the State.

Lumber production in California reached a new high in 1944, being about 5 percent more than in the peak year of 1943. Although production in the pine region was up 5.4 percent, it is significant to note that the output of ponderosa pine dropped 6.7 percent, while other species generally showed increases, mainly white fir (+60.9 percent), sugar pine (+16.7 percent), and Douglas fir (+9.7 percent). The decrease in the cut of ponderosa pine and the increases noted for other species may be an indication of future trends.

SUMMARY

It is estimated in this study that the fruit and vegetable industries in California used approximately 721 million board feet of shook annually during the 5 years 1940-44. The volume in terms of gross lumber requirements was 841 million board feet. The total lumber requirements in 1944 were only slightly less than the average for the 5 years. The major lumber requirements for different classes of use were: vegetables (291 million board feet), citrus (252 million board feet), deciduous fruits (163 million board feet), car stripping and bracing (55 million board feet), dried fruits (29 million board feet), picking boxes (29 million board feet), drying trays (13 million board feet), dehydrator trays (3 million board feet), and sweatboxes (5 million board feet). The lumber used for containers for marketing fresh products alone was 706 million board feet, or 84 percent of total gross lumber requirements.

Although it is extremely difficult to forecast requirements, most competent observers assume, on the basis of past history and indicated trends of production and utilization, that California fruits and vegetables will retain approximately their present proportion of the national market and that commercial marketing will continue at about the present level. It presumably follows, therefore, that for many years to come annual lumber requirements will remain about as great as the 1940-44 average.

California factories are not able to supply all the shook required. In 1944 plants located in California produced approximately 500 million board feet of agricultural shook, largely ponderosa pine. About 5 percent of this volume (25 million board feet) was shipped mainly to consumers in other nearby States. The 475 million feet remaining supplied about two-thirds of California requirements. Factories located principally in the area from Bend to Klamath Falls in Oregon produced all but a small amount of the deficit of 246 million feet. About 46 percent of total lumber production from the pine region would be needed if the full requirements of the industries of 841 million board feet were supplied within the State.

It is predicted that California's timber supply, particularly ponderosa pine, will continue inadequate in the years ahead. Accordingly, it is expected that fruit and vegetable producers, in addition to using greater quantities of lumber from less desirable species, will be forced to rely more on lumber sources outside the State or to develop suitable substitute materials.

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